A high current density Li^+ alumino-silicate ion source for target heating experiments

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The NDCX-II accelerator has been designed for target heating experiments in the warm dense matter regime. It will use a large diameter (≈ 10.9 cm) Li^+ doped alumino-silicate source with a pulse duration of 0.5 μs, and beam current of ≈ 93 mA. Characterization of a prototype lithium alumino-silicate sources is presented. Using 6.35 mm diameter prototype emitters (coated and sintered on a ≈ 75% porous tungsten substrate), at a temperature of ≈1275° C, a space-charge limited Li^+ beam current density of ≈ 1 mA/cm^2 was measured. At higher extraction voltage, the source is emission limited at around ≈ 1.5 mA/cm^2, weakly dependent on the applied voltage. The lifetime of the ion source is ≈ 50 hours while pulsing the extraction voltage at 2 to 3 times per minute. Measurements under these conditions show that the lifetime of the ion source does not depend only on beam current extraction, and lithium loss may be dominated by neutral loss or by evaporation. The thickness of the coating does not affect the emission density. It is inferred that pulsed heating, synchronized with the beam pulse rate may increase the life time of a source.

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